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MATHEMATICS

Paper 1

2024

$2\ ^{1}/_{4}$ hours

MATIGO EXAMINATION BOARD

Uganda Certificate of Lower Secondary Education

PRE MOCK EXAMINATIONS 2024

MATHEMATICS

Paper 1

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

*This paper consists of **two** sections; **A** and **B**. it has six examination items.*

*Section **A** has **two** compulsory items.*

*Section **B** has **two** parts **I** and **II**. Answer **one** item from each part.*

*Answer **four** examination items in all.*

*Any additional item(s) answered will **not** be scored.*

All answers must be written in the answer booklet(s) provided.

Graph paper is provided.

Silent, non-programmable scientific calculations and mathematical tables with a list of formulae may be used.

SECTION A

Answer all items in this section.

Item 1

Customers of your family cake making company have always complained of too much sugar ingredient in the cakes bought. The company has 25 bakers together who can make 480 cakes in three days. However, your company has been hired to make 960 cakes in the five days remaining for a fourth coming cake festival in your town. The managing director has hired more 8 bakers and you have been selected to do a survey from the nearby related company to solve the problem of too much sugar in cakes. It has been realized that a delicious cake requires Sugar, coconut oil and flour that are mixed in the ratio of 2:3:5 respectively, each cake contains 0.75kg of flour.

Hint:

1 kilogram of sugar costs Shs 5,000.

500 grams of coconut oil cost Shs 3,500

1 kilogram of flour costs Shs 8,000

Task:

(a) Help your family to find if the available number of bakers can produce the required number of cakes in the stipulated time and advise them accordingly

(b) Establish the total cost of sugar, coconut oil and flour required to make 960 delicious cakes. (20 scores)

(a) 25 bakers can make 480 cakes in three days

$\Longrightarrow$1 baker can make $\frac{480}{25}$ cakes in thee days

$\Longrightarrow$1 baker can make $\frac{480}{25\times3}$ cakes in one day

$\Longrightarrow$1 baker can make $\frac{480}{25\times3} \times 5$ cakes in five day

If 8 more beakers are added, then it implies we have 33 bakes

Since 1 baker can make $\frac{480}{25\times3} \times 5$ cakes in five day

$\Longrightarrow$33 baker can make $\frac{480}{25\times3} \times 5 \times 33 = 1056$ cakes in five day

Since the available bakers can make 1056 which is more than the 960 cakes that are required for the festival then the 33 bakes are enough.

(b)

Total ratio $= 2 + 3 + 5 = 10$;

Given that each cake contains 0.75kg of flour

$\Longrightarrow\frac{5}{10}$ of total mass of the ingredients $= 0.75$kg

$\Longrightarrow$Total mass of the ingredients $= \frac{10}{5} \times 0.75 = 1.5$kg

For sugar,

Mass of the sugar $= \frac{2}{10} \times 1.5 = 0.3$kg

Given, 1 kg of sugar costs Shs 5,000.

0.3kg of sugar costs Shs $5{,}000 \times 0.3 =$ Shs 1500

$\Longrightarrow$one cake require a cost of Shs 1500 for sugar

$\Longrightarrow$960 cakes require a cost of Shs $1500 \times 960 =$ Shs 1440,000of sugar

For coconut oil

Mass of coconut oil $= \frac{3}{10} \times 1.5 = 0.45$kg

500 grams of coconut oil cost Shs 3,500

Or 0.5kg of coconut oil cost Shs 3,500

0.45kg of coconut oil costs Shs $3{,}500 \times \frac{0.45}{0.5} = \text{Shs } 3150$

$\Longrightarrow$one cake require a cost of Shs 3150 for coconut oil

$\Longrightarrow$960 cakes require a cost of Shs $3150 \times 960 = \text{Shs } 3024{,}000$of coconut oil

For flour

1 kilogram of flour costs Shs 8,000

0.75kg of flour costs Shs $8{,}000 \times 0.75 = \text{Shs } 6000$

$\Longrightarrow$one cake require a cost of Shs 6000 for flour.

$\Longrightarrow$960 cakes require a cost of Shs $6000 \times 960 = \text{Shs } 5760{,}000$of flour.

Item 2

A camping supply company produces back packs in two models; journey and trek. The journey models require 4 hours of labour and the company makes a profit of Shs 40,000. The trek model requires 6 hours of labour and the company makes a profit of Shs 80,000. The distributor will accept no more than 4 trek models and 15 journey models per week.

Task:

(a) Write mathematical statements that show the relation between the two models.

(b) Show the feasible region of the relation on the Cartesian plane.

(c) If you were the manager, determine the minimum number of hours of labour that are required for the company to make a profit of at least Shs 400,000 per week. (20 scores)

(a)

Model	Journey	Trek
Labour	4	6
profit	40,000	80,000
Max time	15	14

Let x and y be the number of journey and trek modes respectively

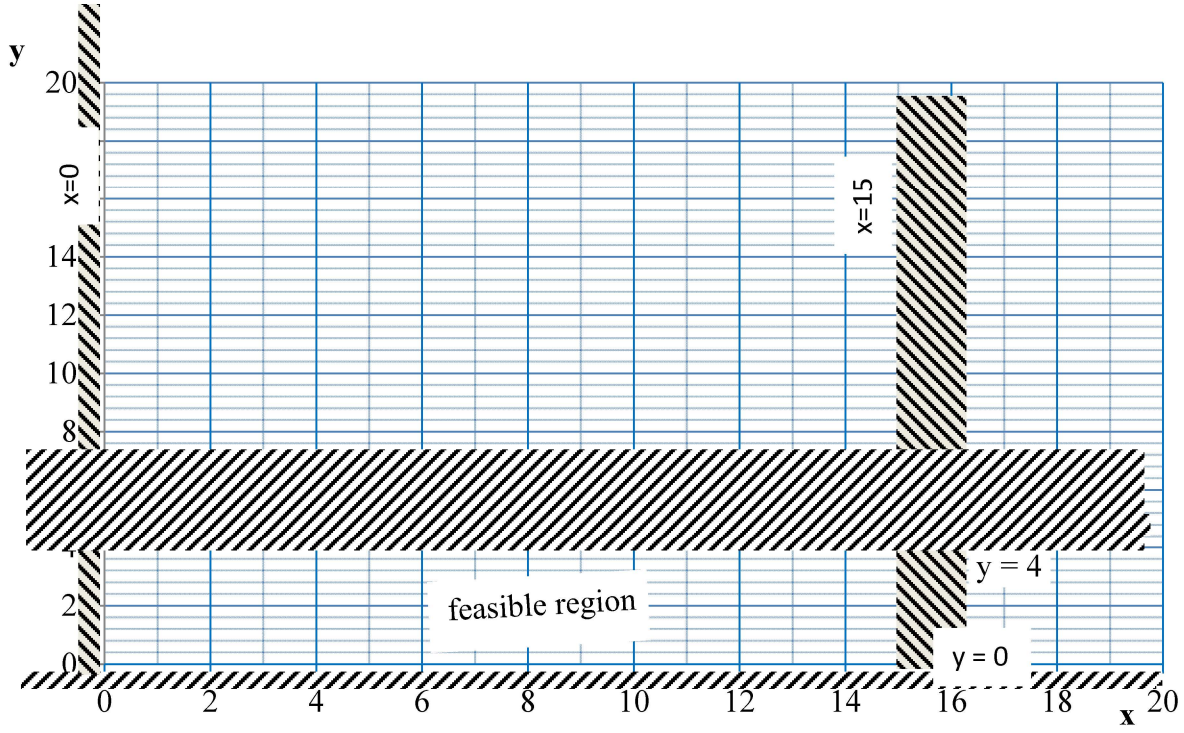
$Total\ profit = 40{,}000x + 80{,}000y$

$Total\ Labour = 4x + 6y$

$$x \leq 15$$

$$y \leq 4$$

(b)



(c)

The points in the feasible region are, (0,0), (15,0), (15,4) and (0,4)

For (0,0),

$Total\ profit = 40{,}000(0) + 80{,}000(0) = \text{Shs } 0$

$Total\ Labour = 4(0) + 6(0) = 0 \text{ hours}$

For (15,0),

$Total\ profit = 40{,}000(15) + 80{,}000(0) = \text{Shs } 600{,}0000$

$Total\ Labour = 4(15) + 6(0) = 60 \text{ hours}$

For (15,4),

$Total\ profit = 40{,}000(15) + 80{,}000(4) = \text{Shs } 920{,}000$

$Total\ Labour = 4(15) + 6(4) = 84 \text{ hours}$

For (15,4),

$Total\ profit = 40{,}000(0) + 80{,}000(4) = \text{Shs } 320{,}000$

$Total\ Labour = 4(0) + 6(4) = 24 \text{ hours}$

Thus minimum number of hours that can produce at least Shs 400,000 for the company is 60 hours

SECTION B

This Section has two Parts; I and II Part I Answer one item from this part

Item 3

A telecommunication company plans to introduce a new minutes bundle on the menu and employs callers to investigate people's opinion on the minutes of the package that will cost Shs 1200. The callers made a survey on random calls of the customers to gather their opinion and use the average minutes. They collected the data collected below.

52	36	76	51	62	67	70	50
45	49	54	58	53	74	64	56
50	80	70	57	64	64	43	78
84	71	85	72	78	43	42	75
84	72	69	49	66	42	65	88

Task:

(a) Giving a reason based on computations using the collected data, suggest the suitable number of minutes to be added on the menu.

(b) The supervisor wishes to know the number of people who prefer minutes greater than 60. Help him/her to estimate this number of people. (20 scores)

(a)

$class$	f	x	$f.x$	cf	$class\ boundaries$
$35-39$	1	37	37	1	$34.5-39.5$
$40-44$	5	42	210	6	$39.5-44.5$
$45-49$	2	47	94	8	$44.5-49.5$
$50-54$	6	52	312	14	$49.5-54.5$
$55-59$	3	57	171	17	$54.5-59.5$
$60-64$	4	62	248	21	$59.5-64.5$
$65-69$	4	67	268	25	$64.5-69.5$
$70-74$	6	72	432	31	$69.5-74.5$
$75-79$	4	77	308	35	$74.5-79.5$
$80-84$	4	82	328	39	$79.5-84.5$
$85-89$	1	87	87	40	$84.5-89.5$
	$\sum f = 40$		$\sum f.x = 2495$		

$$Mean = \frac{\sum f.x}{\sum f}$$

$$= \frac{2495}{40}$$

$$= 62.375$$

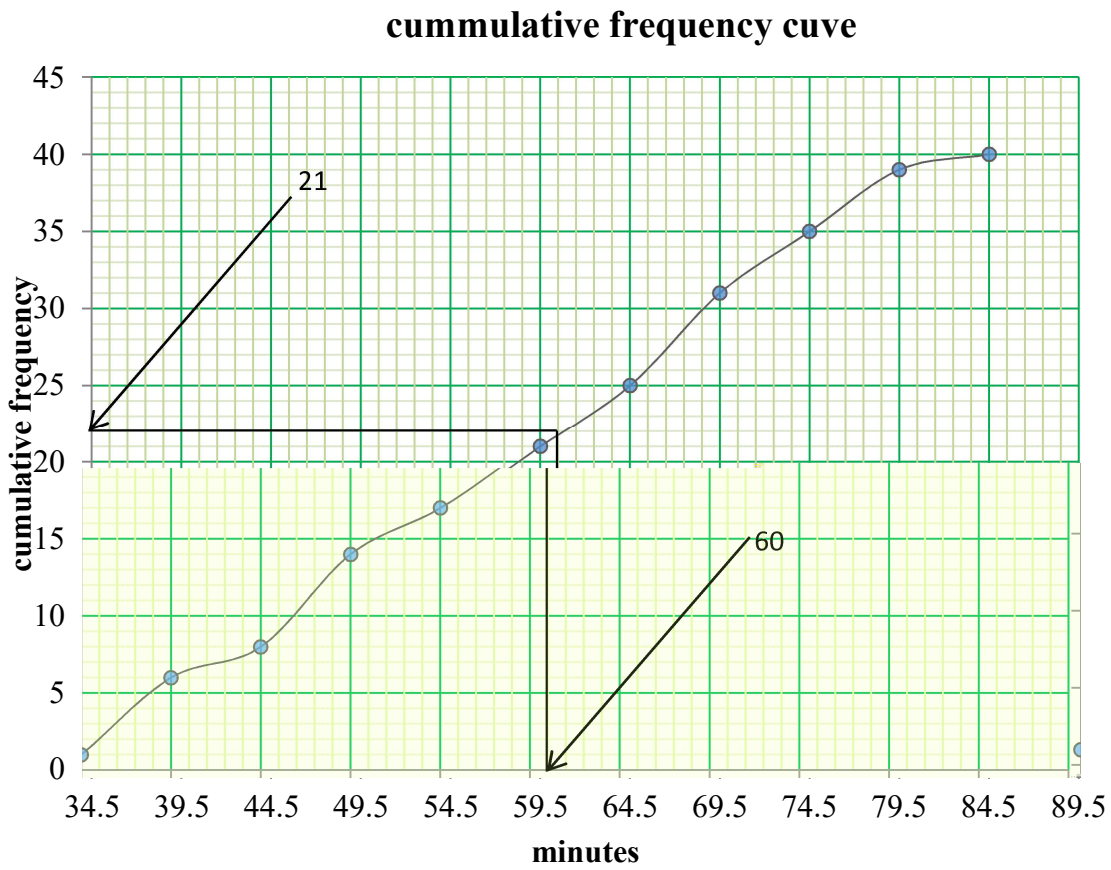
$$Median = l_0 + \left(\frac{\frac{N}{2} - cf_b}{fm}\right) \times i$$

$$= 59.5 + \left(\frac{\frac{40}{2} - 17}{4}\right) \times 5$$

$$= 63.25$$

Since the mean and median are near 65, the number of minutes should be 65.

(b)



21 of people like less than 60 minutes

$40 - 21 = 19$ people like more than 60 minutes

Item 4

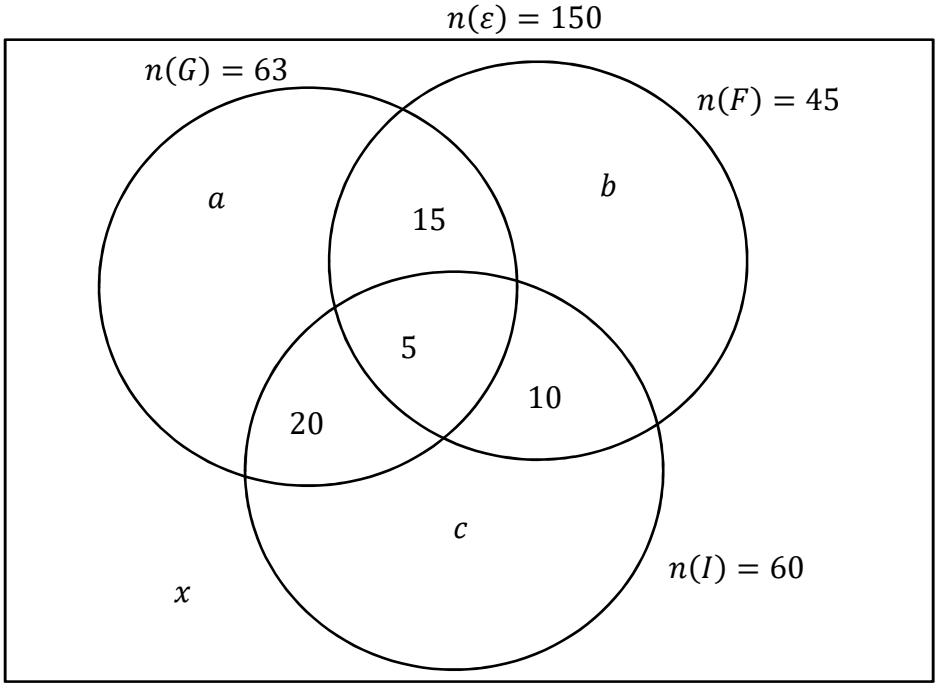
In the bid to determine the likelihood of a particular cell phone being successful on the market, your uncle who owns an electronics workshop tasked you to conduct a survey on 150 people on the streets of your town about the usage of any of these cell phones. Galaxy (G), Flip phone (F), and I-phone (I), then he will decide whether to purchase more of a given type if the likelihood of those who used only that one type exceeds 0.1. 45 owned a flip phone, 60 owned an I-phone, 63 owned a Galaxy, 15 owned a Flip phone and an I-phone, 25 have owned both a Galaxy and an I-phone, 15 have owned both a Galaxy and a Flip phone only and 5 have owned all the three.

Task:

(a) Find out if there are people who have not owned any of the three.

(b) Calculate the probability of people who owned only one type of cell phone.

(c) Advise your uncle on whether to purchase more of these types (20 scores)



$n(G \cap F' \cap I') = n(G) - n(G \cap F \cap I) - n(G \cap F' \cap I) - n(G \cap F \cap I')$

$\Rightarrow a = 63 - 5 - 20 - 15 = 23$

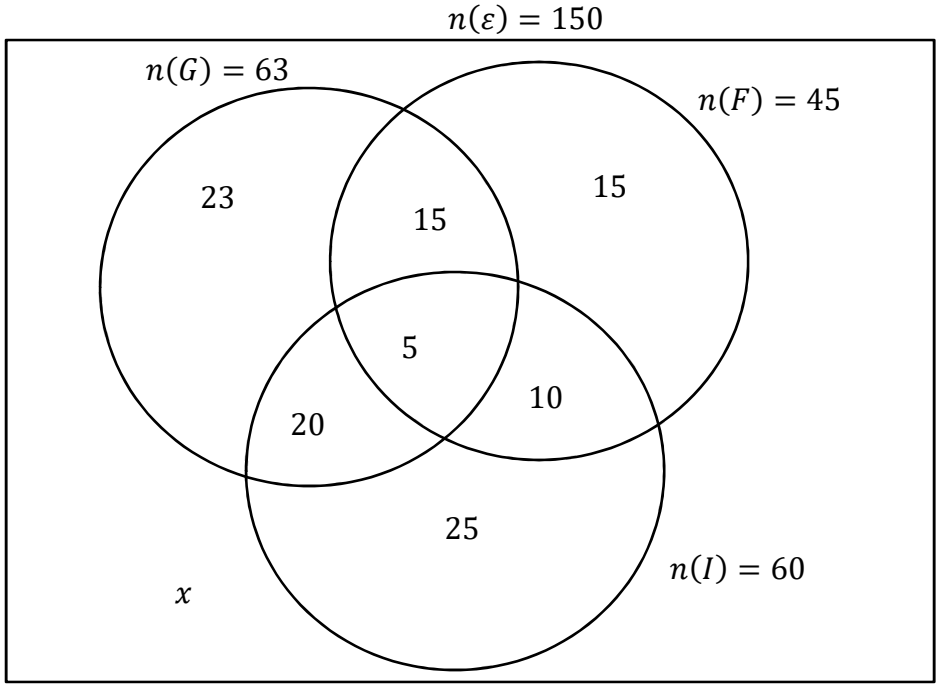
$n(F \cap G' \cap I') = n(F) - n(F \cap G \cap I) - n(F \cap G' \cap I) - n(F \cap G \cap I')$

$\Rightarrow b = 45 - 5 - 10 - 15 = 15$

$n(I \cap F' \cap G') = n(I) - n(I \cap F \cap G) - n(I \cap F' \cap G) - n(I \cap F \cap G')$

$\Rightarrow c = 60 - 5 - 20 - 10 = 25$

(a)



(b)

$n(G' \cap F' \cap I') = n(\varepsilon) - n(G) - n(I \cap F' \cap I') - n(I \cap F \cap G') - n(F \cap I' \cap G')$

$\Rightarrow x = 150 - 63 - 25 - 10 - 15$

$= 37$

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$$p(only\ one) = \frac{n(G \cap F' \cap I') + n(G' \cap F \cap I') + n(G' \cap F' \cap I)}{n(\varepsilon)}$$

$$= \frac{23 + 15 + 25}{150} = \frac{63}{150} = 0.42$$

Since those the likelihood of those who used only type is 0.42>0.1, uncle should purchase more of these phones.

Part II Answer one item from this part.

Item 5

Your brother received Shs 597,000 as a salary and complains of underpayment exhibited in one of the private secondary schools in which he was employed as a teacher at the start of the year. He further says the biggest percentage of his money goes to the government as tax. On acquiring the job he signed a three-year contract with the following terms and conditions. A teacher's monthly gross income has certain allowances deducted from it before it is subjected to the government income tax band. The allowances are as follows.

- Married teacher Shs 18,000 per month
- Un married teacher Shs 12,000 per month
- Each child below 11 years Shs 5,000 per month
- Each child above 11 years but below 18 years Shs 7,000 per month
- Each lesson taught Shs 3,000
- Each examination invigilated Shs 5000
- Meeting allowance Shs 50,000 per meeting
- Housing allowance Shs 240,000 per month
- Lunch allowance Shs 2,000 per day

Government Income Tax Band

Your brother earns a monthly a gross pay of 1,240,000 he is married with 3 children of ages 10, 15 and 19. Given that he has 64 lessons taught in a month, attended beginning of term staff meeting and invigilated 5 examination sessions.

Hint: A month has 30 days.

Task:

(a) Help him find how much money and its percentage he pays to the government as tax.

(b) Establish the take home pay of your brother and advise him if there could be something wrong with his payment transactions. (20 scores)

(a)

Allowances

Married teacher	18,000
Each child below 11 years	5,000
Each child above 11 years but below 18 years	7,000
Each lesson taught	$3{,}000 \times 64 = 192000$
Each examination invigilated	$5000 \times 5 = 25000$
Meeting allowance	50,000
Housing allowanc	240,000
Lunch allowance	$2{,}000 \times 30 = 60000$
total allowance	597,000

$$Taxable\ income = gross\ pay - allowances$$

$$= 1240{,}000 - 597{,}000$$

$$= 643{,}000$$

Taxes

$Taxable\ Income\ (Shs)$	$Rate\ (\%)$	$amount\ taxed$ tax	$amount\ remaining$
$0-100{,}000$	10	$100{,}000\times\frac{10}{100}=10000$	643,000
$100{,}001-200{,}000$	25	$100{,}000\times\frac{25}{100}=25000$	633,000
$200{,}001-300{,}000$	30	$100{,}000\times\frac{30}{100}=30000$	608,000
$300{,}001-400{,}000$	40	$100{,}000\times\frac{40}{100}=40000$	578,000
$400{,}000\ and\ above$	50	$578{,}000\times\frac{50}{100}=289000$	538,000
$Total\ tax$		394000	249,000

$$Total\ tax = 394000$$

$$percentage\ tax = \frac{Total\ tax}{gross\ pay}\times 100$$

$$=\frac{394000}{1240{,}000}\times 100$$

$$=31.77\%$$

(b)

$$Net\ pay = gross\ pay - total\ tax$$

$$=1240{,}000-394000$$

$$=846{,}000$$

Item 6

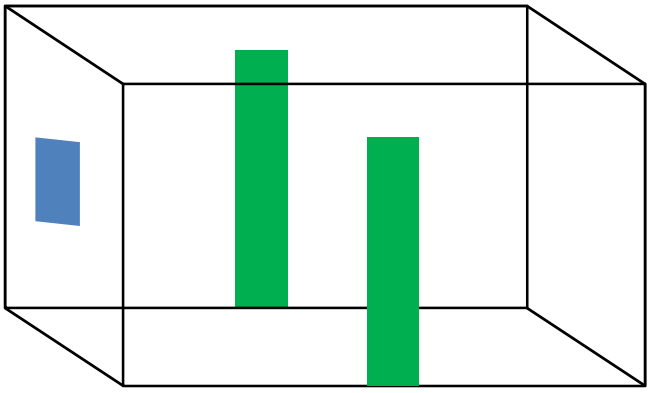
A family decides to paint the inner walls of its living room for New Year celebrations with a budget of Shs 400,000. The room is 5m long, 4m wide and 3m high. The room has two painted doors in the middle of the walls opposite to each other. Each door is 2m high and 0.75m wide. The room has one painted window in one of the side walls which is 1m square. A painter charges Shs 800 per square meter painted and for every 10m square wall painted fully, consumes a 4 litre tin paint which he sells at Shs 70,000.

Task:

As a mathematics student;

(a) Establish computations to find out if the budgeted money could be enough for this work.

(b) If a painter offers a discount of 10% on labour and 5% on every litre of paint. How much money shall the family save? (20 scores)



$$\begin{aligned} Total\ surface\ area\ of\ the\ room &= 2(LW + LH + HW) \\ &= 2(5 \times 4 + 5 \times 3 + 4 \times 3) \\ &= 2(20 + 15 + 12) \\ &= 94m^2 \end{aligned}$$

$Area\ of\ the\ doors\ = 2lw$

$= 2 \times 2 \times 0.75$

$= 3m^2$

$Area\ of\ the\ window\ = 1m^2$

Assuming the house has a ceiling and the floor are not to be painted,

$Area\ of\ the\ ceiling\ and\ floor\ = 2LW$

$= 2 \times 5 \times 4$

$= 40m^2$

$Area\ to\ be\ painted = 94 - 3 - 1 - 40 = 50m^2$

$Amount\ required\ by\ the\ painter = 50 \times 800 =$ shs 40,000

$number\ of\ 4 - litre\ tin\ paint\ to\ be\ bought = \frac{50}{10} = 5\ tins$

$Amount\ required\ for\ buyng\ the\ paint = 5 \times 70{,}000 =$ shs 350,000

$Total\ expenses = 40{,}000 + 350{,}000 =$ shs 390,000

Since the total expenditure is shs 390,000 $<$ shs 400,000, then budgeted money is enough

(b)

$Discount\ offered\ by\ the\ painter = \frac{10}{100} \times 40{,}000 =$ Shs 4,000

$Cost\ of\ litres\ of\ paint = \frac{70{,}000}{4} = 17500\ litre$

$Number\ of\ litres\ bought = 5 \times 4 = 20\ litre$

$Discount\ offered\ on\ paint = 20 \times \frac{5}{100} \times 17{,}500 =$ Shs 17,500

$$Amount\ saved = 4{,}000 + 17{,}500 = \text{shs } 21{,}500$$